production. In other words, nature, here, is economizing effort and following the line of least resistance. This accords with the fact that prostrate and low climbing branches do not bloom and that fruit and flowers are found only in positions where the opportunity for vegetative multiplication is restricted or wanting. In fact, the most remarkable crop of both fruit and flowers that I remember ever to have seen, was on a vine climbing over a wire fence between a cotton field and a potato patch, where the farmers were giving it such a hard fight that it had no chance to spread over the ground and was obliged to find some other outlet for its vital energy.

ROME, GEORGIA

VARIATIONS IN THE FLOWERS OF ERYTHRONIUM PROPULLANS GRAY

BY C. O. ROSENDAHL

Several species of the genus *Erythronium* are characterized by certain structural peculiarities of the flowers chief of which is the marked heteromorphism of the stamens. This has been demonstrated in two of our common eastern species, *E. albidum* and *E. americanum* by Meads* and Graff† and in a number of western and mid-western species by Pickett.‡ Among those studied by Pickett is *E. propullans*, a somewhat peculiar species which, so far as definitely known, is limited in its distribution to a small geographical area of southeastern Minnesota. In this restricted area it has been found only in a few places in the valleys of the Cannon and the Zumbro rivers, where it grows on wooded, alluvial bottomlands.

As a result of the very limited distribution of the species there are comparatively few specimens of *E. propullans* in the herbaria of the country and Pickett states that his observations on it were

* Meads, M. E. The Range of Variation in Species of *Erythronium*. Botanical Gazette 18: 134–138. 1893.

† Graff, Paul W. The Stamens in *Erythronium Americanum*. Torreya 16: 180–182. 1916.

‡ Pickett, F. L. The length of *Erythronium* Stamens. Torreya 17: 58–60. 1917.

confined to only a few plants. He makes the suggestion that it would be desirable to examine more extensive collections to see if stamen dimorphism is characteristic of the species and accordingly the writer made it a point to look over the specimens of it in the herbarium of the University of Minnesota to see if additional proof could be obtained. The observations on the herbarium material were supplemented by a study of numerous specimens in the field in May, 1918.

These observations show beyond any doubt that the stamens of *Erythronium propullans*, like those of several other species of the genus, are characteristically heteromorphic. In fact there is perhaps an even greater proportional difference in the lengths of the two sets of stamens than is found in the other species, for in *E. propullans* the outer whorl of stamens reaches scarcely above the base of the anthers of the inner set. The accompanying stereoscopic photographs, which were made with a Zeiss stereoscopic camera with regular binocular objectives and with the flowers immersed in water, show this fact clearly. (The value of the figures is enhanced by examining them through an ordinary stereoscope.)

In the field material the average length of the outer stamens is 6.32 mm. while that of the inner is 7.99 mm., a difference of 1.67 mm. There is considerable variation in the size of the anthers ranging from 1.9 mm. to 3.5 mm. in length. The average length is about 2.46 mm. In some flowers the anthers of the outer stamens are regularly about .5 mm. shorter than those of the inner but this is not generally the rule and many cases were noted in which the anthers of the inner stamens were smaller in size than the outer. For the most part the anthers of one whorl of stamens differ as much from one another in size as they differ from those of the alternating whorl. This marked tendency to variation in the length of the anthers does not seem to affect the filaments for in all flowers examined the outer filaments were found to be constantly and uniformly shorter than the inner ones.

While examining the flowers for stamen heteromorphism another feature was brought to light which apparently has hitherto

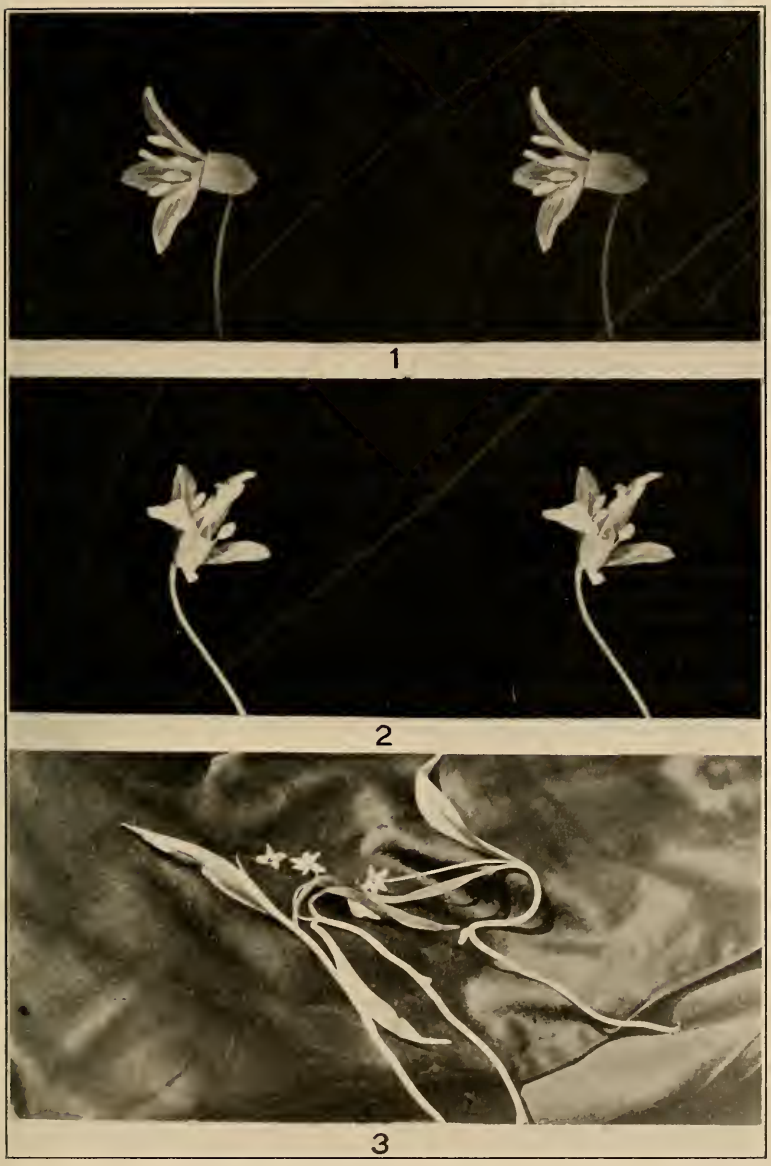

FIG. 1.—A flower of *Erythronium propullans* with four perianth segments and four stamens, showing the pronounced difference in the lengths of the two sets of stamens. Fig. 2. A flower with five perianth segments and five stamens, two of which are long and three short. Fig. 3. Three plants of *E. propullans* showing flowers with four, five and six perianth segments. On two of the plants the young offshoot can be distinctly seen.

been overlooked in *E. propullans*, namely a remarkable variability with regard to the number of the perianth segments, stamens and carpels.

Of a total number of 51 flowers examined in detail only six had six complete or normal perianth segments and only three of these had the full complement of stamens. Three flowers had five normal perianth segments and one of reduced size. There were eleven flowers with five perianth segments and twelve with five stamens. By far the largest number of flowers, namely thirty-one, had four perianth segments and there was a total of thirty-four which had only four stamens. One flower had three stamens and another one had only two. The following tabulation shows the variations in a more graphic way:

No. of perianth segments	6	5 + 1 abnormal	5	4	No. of stamens.	6	5	4	3	2
No. of flowers.....	6	3	11	31		3	12	34	1	1

It is thus obvious that only about 12 per cent. of the flowers possess the full number of perianth parts and only about 6 per cent. the full number of stamens. On the other hand about 61 per cent. of the flowers have only four perianth segments and fully 67 per cent. have only four stamens. About 21 per cent. of the flowers have five perianth parts and 23 per cent. have five stamens. Where there are only four perianth segments and four stamens each series is arranged in two alternating whorls of two each, the two shorter stamens occupying the outer whorl. In most cases where five perianth segments and five stamens are present the suppression has occurred in the inner whorl of the two respective series, thus leaving three short stamens and two long (Fig. 2). In at least one case the reverse condition with regard to the stamens was observed.

In the typically trimerous flowers the ovary is 3-celled but in the flowers having only four perianth parts and four stamens the pistil is reduced to two carpels and the ovary is 2-celled. In the flowers with five perianth parts and generally five stamens the pistil is usually made up of three carpels with three cells in the

ovary but sometimes one of the carpels is only partially developed, resulting in a somewhat irregular stigma and only two complete cells. In one case a flower with two separate pistils was observed. The pistil, however, shows the least variation in size of all the organs of the flower of *E. propullans*, the style being uniformly 5 mm. in length and the ovary about 3 mm. when the flowers are in anthesis.

So far as the writer is aware the flowers of *E. propullans* are considerably smaller than in any other species of the genus. They vary in length from 9 to 13 millimeters but the majority are a little over 10 mm. long. Attempts to ascribe to other factors than heredity the difference in the size of flowers of various related species of a genus are mostly futile, yet the hypothesis put forth by Blodgett* in explanation of the reduction in the size of the flowers of *E. propullans* seems to the present writer at least very plausible.

As is well known the offshoot in *E. propullans* pushes out from the stem near the middle (Fig. 3), its bud originating "at the base of the peduncle in the axil of one of the leaves." Thus the "vascular system of the peduncle supplies, through branches, the necessary strands for the offshoot." This side-tracking of a considerable amount of the food supply going up the peduncle may have had, in the opinion of Blodgett, "considerable influence in the reduction in size noticeable in the flowers of this form in contrast to the rest of the genus."

It seems very probable that the prevalent reduction in the number of the floral organs is due to the same cause and we have, at least in this species, a very simple physiological explanation for the fluctuations in the floral structures.

In conclusion it is worth noting that the genus *Erythronium* belongs to a subfamily of the Liliaceae in which the trimerous plan of the flower is quite consistently adhered to. The characteristic variations in the number of the perianth segments, stamens, and carpels and especially the preponderance of dimerous flowers in *E. propullans* are therefore very striking.

* Blodgett, F. H. The Stem Offshoot in *Erythronium propullans* Gray. Johns Hopkins University Circular, 3–5. June, 1909.